VIBER X3™

Manual Ver. 3.0

Refers to **VIBER X3**™ rev: 1.7

Software 5.0

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Our x-series of hand-held instrument

VIBER X1™

VIBER X2™

VIBER X3™

VIBER X5™

1 Important information

Safety precautions

Vibration measurement and balancing involves measurement on rotating machines. Keep a safe distance to rotating parts and secure transducers and transducer cables from rotating parts. Always follow internal, local and national security regulations! When working with weights on the rotor always secure the start switch with a locker and also use the emergency switch for double safety. This is especially important when the machine is remote controlled.

VMI takes no responsibility for any accidents on people and machines.

VMI and our authorized dealers will take no responsibility for damages on machines and plants as the result of the use of **VIBER X3™** measurements. VMI has the aim to improve and develop our products, why surely an upgraded version of this manual will be distributed in the future. As a result of this, we might change and correct these items in later issues without further notice. Also changes in the **VIBER X3™** equipment may take place that affect the accuracy of the information.

2 Introduction

VIBER X3™ is designed for maintenance/repairer and operators personnel. It is an excellent tool, for basic condition monitoring checks, easy to use and reliable for status analyse. The **VIBER X3™** instrument has the following features:

- Accurate measurements in 4 selectable frequency ranges. Gives higher reliability.
- Real-time measurement of the total vibration level and the Bearing Condition (BC), measures and displayed simultaneously, facilitate analysis of Bearing faults.
- Headphone set with volume control and high pass filter for Bearing noise detection. Can be used without BC measuring and trending, to save time. Uses if there are many small Bearings as in printing machines or conveyors and similar applications.
- Listening to bearing sound while comparing the displayed BC value.
- Fast and easy fault analysis screen displaying the five highest peaks with amplitude and frequency one by one.
- Measurement units and measurement presentation may be selected by the user from the following list:
  - g-value = (RMS, Peak or Peak-Peak)
  - a = m/s^2 (RMS, Peak or Peak-Peak)
  - V = mm/sec (RMS, Peak or Peak-Peak)
  - V = inch/sec (RMS, Peak or Peak-Peak)
  - D = mils (RMS, Peak or Peak-Peak)
  - D = µm (RMS, Peak or Peak-Peak)
- Bearing Condition measurements in a wide frequency range (0, 5 - 16 kHz).
- Built-in infrared temperature sensor, units in °C or °F.
- Bar indicator shows measurement stability.
- Vibration, temperature and danger alarms by red and yellow colour LED's.
- Fast battery charging capacity using an external charger, provided in the delivery.
- Display with backlight.
- Adjustable Auto-shut off for energy saving.
- Dust and waterproof, for rough use (IP 65).

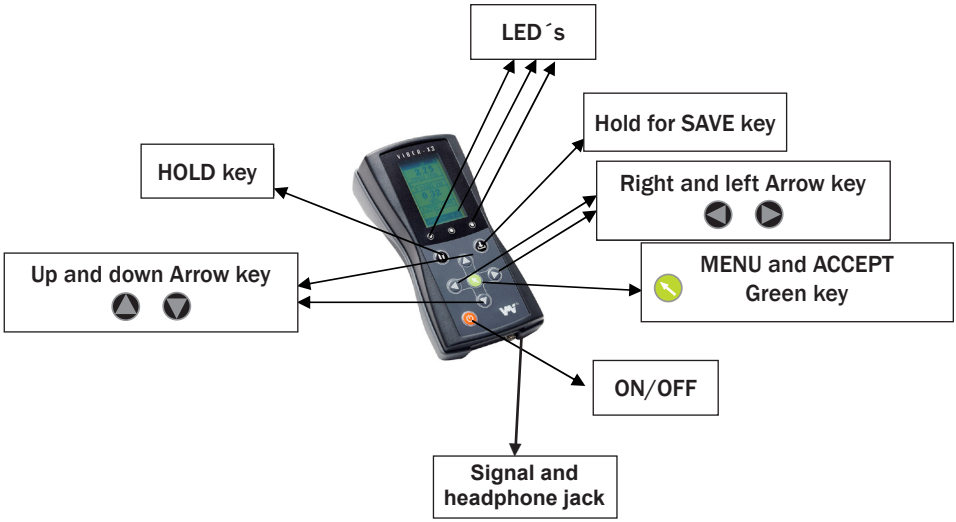
3 Scope of supply

A complete delivery is:

- **VIBER X3™**, machine condition analyzer
- A high performance accelerometer
- 1 m transducer cable
- Extension tip, magnet
- Battery charger
- Head phones
- Data storage with “VMI Trend View” software, installation instructions and user manual
- Printed manual for instrument and software

All this together are available in a sturdy, airtight, chemical resistant, dust- and waterproof IP68 case.

4 Instrument keypad and LED´s



The **VIBER X3™** keypad

1 ON/OFF Orange key

1 MENU and ACCEPT Green key

1 Hold for SAVE key for Route and Balancing measurements

1 Hold key

4 Arrow white keys

1 Green LED lights, when any key is pressed.

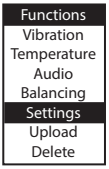
1 Yellow LED lights, when the measurement is above the warning set level.

1 Red LED lights, when the measurement is above the danger set level.

NOTE: As default, when the instrument starts, the transducer power is ENABLED

5 Setting Menu and Functions

In the Function and Setting Menu you can set or choose menus or functions by using Arrows and green Button for navigation.



1. Vibration: Green button choose to measure vibration

2. Temperature: Green button choose to measure Temperature

3. Audio: Green button choose to open Audio mode, make start of liste ning possible, default is enabled.

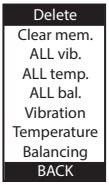
4. Balancing: Green button choose balancing, choose a new or an Ongoing

5. Settings: Use for make settings for the functions:

- Instrument, Backlight on/off, Auto-shutoff, Language (Imple mented languages are: English, Swedish, French, German, Romanian, Czech, Spanish, Portuguese and Finnish).
- Transducer, sensor sensitivity and power On/Off
- Vibration, Set level and enable or disable Alarm, Warning, Units displayed
- Temperature, Unit, Emissivity, set level and enable or disable Alarm, Warning
- Audio, Filter On/off, Sound enable or disable

6. Upload: Choose to upload saved measurements and balancing results

7. Delete: Used to remove stored measurements.



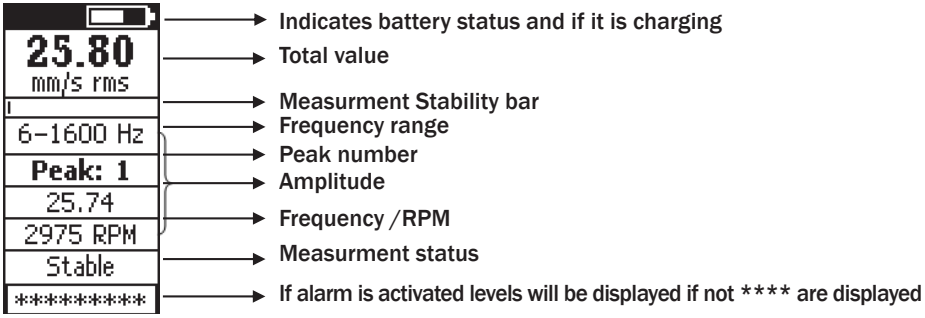
To remove one measurement from the VIBER X3™ memory list: use the ”**Hold for Save**” button. The function ”**delete**” in the menu for deletion can also be used to view stored measurements in VIBER X3™ memeory list, exit from the memory list with the ”**Hold for Save**” button.

6 Screen descriptions

6.1 Analysis measurement screen

In the analysis screen you are able to see the total value as well as the amplitude and frequency of the five highest peaks in the spectrum range. If you have enabled the audio (see audio screen) you may also at the same time listen to the bearings.

In the upper right corner you will see the battery status and if the charger is plugged in or not.



Measurement status can be one of following:

- **Measuring** (Vibration measuring is ongoing)

- **Autoranging** (The instrument is calculating the best measurement level range)

- **Averaging** (Averaging of the measured data)

- **OK** (The measurement is stable)

- **Overflow** (The signal is too high – the measurement is incorrect/not readable.)

In case of amplitude out of range, the value is shown as 3 stars (***).
When the measurement is stable, the last message line shows OK.

The frequency appears as follows:

Frequency range	Frequency range of peak detection
2 - 400 Hz	2 - 400 Hz
6 - 1600 Hz	6 - 1600 Hz
11 - 3200 Hz	11 - 2000 Hz
10 - 1000 Hz	10 - 1000 Hz

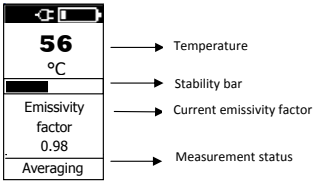
The following item settings are available:

Item	Value	Notes
Backlight	ENABLED or DISABLED	
Auto-shutoff	ENABLED or DISABLED	Shutoff after 60 seconds
Setting	20 sec, 30 sec, 40 sec, 1 min, 2 min and 3 min	Set the Auto-shutoff
Unit	g (RMS, Peak or P-P) m/s^2 (RMS, Peak or P-P) mm/s (RMS, Peak or P-P) µm (RMS, Peak or P-P) inch/sec (RMS, Peak or P-P) mils (RMS, Peak or P-P)	
Range	2 - 400 Hz 6 - 1600 Hz 11 - 3200 Hz 10 - 1000 Hz	
Alarm *	ENABLED or DISABLED	
Warning	Default value 6.00	Keep key pressed to auto-repeat
Danger	Default value 11.0	Keep key pressed to auto-repeat
Language **		(Depending of firmware version)
Sensitivity (mV/g)	During calibration the transducer sensitivity can be adjusted between 0,1 to 99999 mV/g	Do not change after instrument calibration. Set sensitivity in accordance with the transducers
Transducer power	ENABLED or DISABLED	4 mA for accelerometer
Frequency	RPM or Hz	

** Can only be set for units mm/s and in/s RMS*
*** Standard languages are: English, Swedish, French, German, Czech, Romanian, Spanish, Portuguese and Finnish. For another language please contact your instrument supplier for avaliability*

6.2 Temperature measurement screen

In the temperature screen you see the temperature of the object you are measuring.



Temperature measurement status can be one of following:

Averaging (Averaging of the measured data)

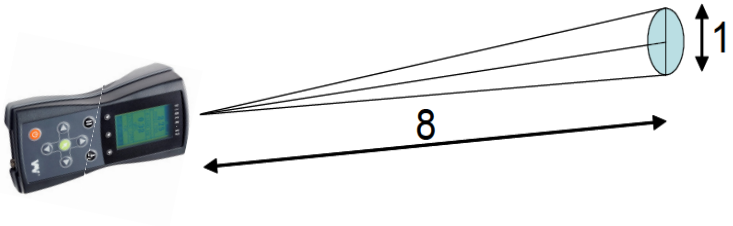
OK (The measurement is stable)

Overflow (The signal is too high – the measurement is incorrect/not readable.)

In case of amplitude out of range, the value is shown as 3 stars (***).
When the measurement is stable, the last message line shows OK.

Available measurement units are Celsius (°C) and Fahrenheit (°F).

Direct the IR temperature transducer towards the surface you want to measure. Keep a distance of approximately **200-500 mm (8- 20 inches) between the instrument and the object.** Reduce the distance between the object and the instrument in accordance with the surface size.
Note: when you get the temperature that differs most to the surroundings, then you probably have got the right direction.



The measurement surface size related to the distance 8:1

When (MENU) key is pressed, the Temperature Settings menu is shown.

The following temperature settings are possible:

Item	Values	Set the Auto-shutoff time
Backlight	ENABLED or DISABLED	
Auto-shutoff	ENABLED or DISABLED	
Setting	20 sec, 30 sec, 40 sec, 1 min, 2 min, 3 min	Set the Auto-shutoff time
Unit	°C or °F	
Alarm	ENABLED or DISABLED	
Warning	0,00 - X	Keep key pressed to auto-repeat
Danger	0,00 - X	Keep key pressed to auto-repeat
Language		If nothing else is specified at order English will be pre set
Emissivity	0,79 - 1,00	Should be set in accordance with the target surface

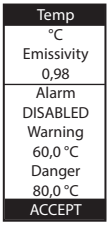
Emissivity:

Set the coefficient for surface reflection factor (Emissivity factor) using the table below or check via a contact probe.

Material	Emissivity factor
Heat, sink, black anodized	0.98
Paper	0.97
Black paint, matt	0.97
Ice, smooth	0.97
Wood	0.94
Glass	0.94
Rubber, hard	0.94
Transformer paint	0.94
Concrete	0.93
Brick, mortar, plaster	0.93
Porselain	0.92
Steel, oxidized	0.79
Copper, oxidized	0.76
Steel, heat treated surface	0.52
Copper	0.04
Aluminium, bright	0.04

Don't use

Warning!
Incorrect setting of the emissivity factor can lead to considerable errors of measured temperature.



To change **Emissivity factor,** in the **Function menu** go to **Settings** then go to **Temp** scroll down to **Emissivity** and use the arrow keys to change the value.

To exit Settings menu, just press again the (MENU) key. All settings will be stored into the permanent FRAM memory.

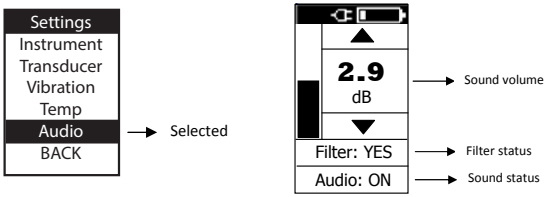
6.3 Sound screen

Listening to machine sounds enables analysis of gears and low speed bearings (<300 RPM) in an alternative way and can improve analysis speed and quality.
VIBER X3™ makes it possible for the user to listen to the machine while at the same time seeing the vibrations in the instrument display.

Note that you must choose the Vibration Screen while the sound is enabled to see the vibration signal.

> Warning!
> To protect your hearing, you should always remove the headphones from your ears when you move the sensor or re-connect the cable.

When a headphone set is connected to the **VIBER X3™**, the **Sound Screen** can be used to adjust the sound volume (depending on hardware version there is also a volume control on the headphone cord). Before changing volume, the SOUND function must be ON. Sound output status is enabled (ON) or disabled (OFF) in the **Sound Settings** menu.



When the (MENU) key is pressed, the Sound Settings menu is shown.

Filter:
When the filter status is set to YES a high pass filter is activated enabling the user to only listen to machine noise in high frequencies.

Audio:
When Audio is ON, using the (LEFT) and (RIGHT) arrows, the sound level can be adjusted. To do this, press and keep the LEFT or the RIGHT arrow key pressed. The volume will increase/decrease slowly.
Depending on hardware version the headphone set can also be equipped with a volume control on the cord.

As safety precautions and to save battery the audio settings are always reset, turning the audio off, when the instrument is started.

Note: With a headphone inserted, at the maximum volume level, the power consumption will increase with 150 mA. To save the battery power, turn the audio off when it is not used. When the battery voltage is beginning to be too low and headphone set is plugged-in, the instrument will be automatically reset. When the instrument is reset, as default, the sound is disabled. In this way the instrument can continue to run for a while longer without the need of charging the batteries.

7 Warning messages

The following message may appear in normal operation:

Calibration lost!

This message may appear if the calibration data is lost from the permanent FRAM memory or if the calibration data are corrupted. In such cases, the instrument must be re-calibrated; otherwise it will measure incorrectly. The message appears only once, and then default calibration data is used.

Battery too low

When this message appears, the battery voltage is too low to ensure a correct running condition. The measurements may be invalid! The instrument battery pack must be charged immediately, using the external charger. In order to temporarily decrease the power consumption, the backlight will be switched OFF. The instrument can still work, but only for a short while. If even in this condition the voltage remains low, the instrument will shut off in 20 sec. Battery charge should not be terminated before the green LED light has gone out.

Shut-off in 5 sec

This message appears only if the Auto-shut off setting is enabled. The user may cancel the shut-off condition, pressing any key except ON/OFF. If no key is pressed the instrument will shut off in 5 seconds.

Missing transducer

This message appears only if you have forgot to connect the transducer, or if transducer is broken.

When the Transducer power setting is disabled, the user has the possibility to use another external source for the vibration input (a signal generator or a buffered output from another device).

When the instrument starts, the Transducer power setting is always ENABLED. When this message appears, it will remain on the screen, even if the transducer is plugged-in. To continue the normal running mode in such a condition, switch the screen temporarily to another menu.
When you come back, the message disappears.

8 How to interpret vibration levels

A user with no previous experience, should use the ISO 10816-3 standard.

The standard normally calls for a velocity measurement in mm/s RMS. To better understand what this measurement means, think of it as how fast the machine is moving back and forth. This measure gives a good understanding of the amount of “break down energy”, causing mainly wear and fatigue in the machine or the structure.

The instrument measures the total RMS vibration value in the frequency range. This RMS value is the average sum of all the measured vibrations.

Example:
If the simultaneous vibration caused by unbalance is (4mm/s), by misalignment (2 mm/s) and by the gear mesh (5 mm/s) then the total vibration measured with **VIBER X3™** is 6.7 mm/s.

$$\text{Total vibration(RMS)} = \sqrt{4*4+2*2+5*5} = 6{,}7\,mm/s$$

Notice that a reduction of the unbalance from 4 mm/s to 1 mm/s will reduce the total value from 6, 7 mm/s to 5, 5 mm/s.

8.1 ISO standard 10816-3

The ISO standard 10816-3 classifies machines differently whether the machines are considered as flexible or rigid mounted. This reflects the location of the machines stiff-body resonances related to the basic running speed of the machine.

For instance, a machine supported by rubber or spring, have resonances at low running speeds. The machine starts vibrate at certain low revolutions. When the speed is increased above these resonance frequencies, the vibration is reduced. This machine is considered flexible.
Modern machines that have high RPM's and flexible bearing supports and foundations, can be treated as flexible, even when they aren't mounted on rubber or springs.

Group 1:
Large machines with rated power above 300kW. Electrical machines with shaft height H > 315mm. Operating speed ranges from 120 to 15000 RPM.

Group 2:
Medium-sized machines with a rated power above 15kW up to and including 300kW. Electrical machines with shaft height between 160 < H < 315 mm. Operating speed normally above 600 RPM.

Extraction's from ISO 10816-3

Industrial machines with power above 15kW and nominal speeds between120 -15000 r/min

Unit	Group 1 and 3		Group 2 and 4	
mm/s	Rigid	Flexible	Rigid	Flexible
0-1.4				
1.4-2.3				
2.3-2.8				
2.8-3.5				
3.5-4.5				
4.5-7.1				
7.1-11				
11--				

Group 3:
Pumps with multivane impeller and with separate driver with rated power above 15kW.

Group 4:
Pumps with multivane impeller and with integrated driver with rated power above 15kW.

9 Vibration analysis

Recommended vibration levels in mm/s and common findings

The list and table on previous page can be used, as a first consideration, when you approach a machine newly commissioned or after some time in operation. Investigate the reason for any machine that vibrates above 3 mm/s RMS. Do not leave levels above 7 mm/s without analyzing consequences.

0 – 3 mm/s | 0 – 0,12 in/s

Small vibrations - None or very small bearing wear. Rather low noise level.

3 – 7 mm/s | 0,12 – 0,28 in/s

Noticeable vibration levels often concentrated to some specific part as well as direction of the machine. Noticeable bearing wear. Seal problems occur in pumps etc. Increased noise level; try to investigate the reason. Plan an action during next regular stop. Keep the machine under observation and measure at shorter time intervals than before to detect a deterioration trend if any. Compare vibrations to other operating variables.

7 – 11 mm/s | 0,28 – 0,43 in/s

Large vibrations. Bearings running hot. Bearing wear-out cause frequent replacements. Seals wear out, leakage of all kinds evident. Cracks in welding and concrete foundations. Screws and bolts are loosening. High noise level. Plan action soonest. Do your best to reveal the reason. You are wearing down investments quickly.

11 – mm/s | 0,43 − in/s

Very large vibrations and high noise levels. This is detrimental to the safe operation of the machine. Stop operation if technically or economically possible considering the plant stop cost. No known machine will withstand this level without internal or external damage. Reduce any further running time to an absolute minimum.

9.1 Resonance

A resonance can easily be found when a flexible machine is running up or down its speed. The resonance frequencies are located at the RPM's, where the vibration has a local maximum level.

To understand a resonance you can compare with the string of a guitar. The string has its natural basic tone that will ring as soon as the string is struck. The actual frequency of the tune depends on the stiffness and the distributed mass of the string.

All machines have similar built in "tones" with corresponding properties consisting of stiffness and a mass in the form of mechanical strings such as shafts, beams, floors and in all mechanical parts. If any natural excitation (=alternating force) in the machine has the same or nearly the same frequency as a resonance frequency the vibration will be amplified in this machine part, and a much higher vibration level will occur.

To identify, measure the vibration levels in three perpendicular directions at the bearings. If you find a measurement with at least three times higher level than in the other directions, consider resonance as a likely possibility. The resonance is amplifying the mechanical force and thus gives a high vibration in that direction. The resonance makes the machine unnecessarily sensitive to mechanical forces.

Actions to handle a resonance are different depending on its location, operating conditions etc. It will normally require experience to alter the situation. One reason is that the modification can affect the basic mechanical design of the machine and normally require the competence of a machine designer.

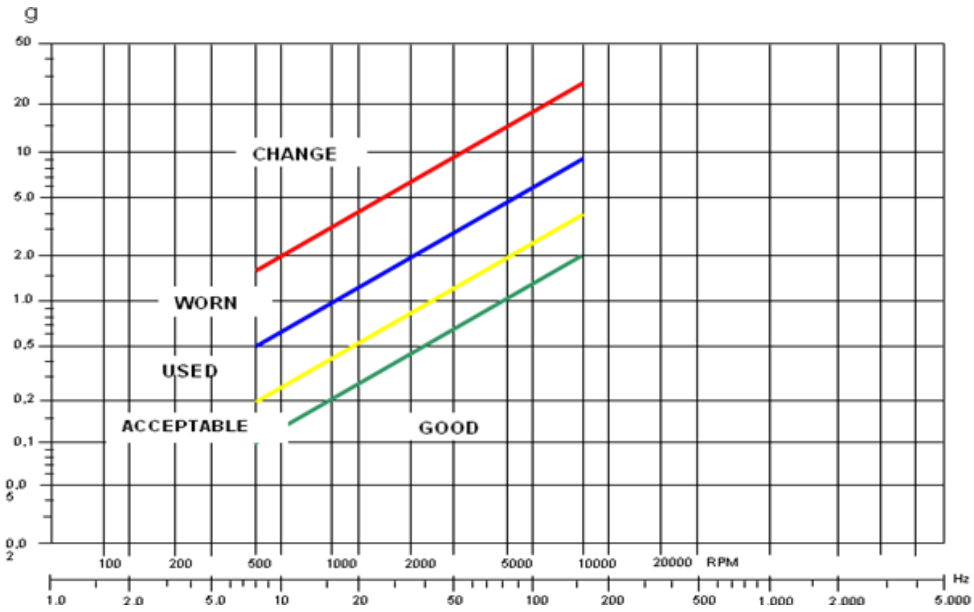
We recommend however to consider such modifications since the change of the resonance frequency normally is cheap compared to the high maintenance cost that will follow any attempt to run a machine under the influence of a resonance.

Sometimes it´s possible to change the speed of machines, which often is a simple solution.

9.2 Recommended bearing condition levels

The bearing condition value is the total RMS value of the acceleration of all high frequency vibrations within the range from 1500 Hz up to 20000 Hz with the unit “g”.

Find the machine speed. Follow this line up to the judgment lines and read the value on the left axis.



The diagram above is a guide to interpret the bearing condition value. If vibrations of other causes (e.g. flow surge, gear mesh) are within in the selected frequency range, this can give a high bearing condition value without the bearing being damaged. A high bearing condition value can also be acquired if the bearing is poorly lubricated or is overloaded (e.g. by misalignment, or large belt forces).

Compare this value with the bearing temperature. If both are high or pointing upwards in the trend analysis you might have a bearing problem.

9.3 Listening to bearing sound

The listening of bearing sound is an old method. Sound analyzes of low speed bearings and gears can sometimes be much faster and even more reliable than just BC-value. With the **VIBER X3™** you can both listen and look at the BC value and vibration at the same time.

10 Balancing with VIBER X3™

This chapter describes how you can perform balancing with your instrument

The 3-Point Balancing method does not need any additional hardware exept for the **VIBER X3™** instrument and the accelerometer. Mount the accelerometer on the bearing and in the direction where you have the highest vibration caused by unbalance. Use this measuring point for all following measurements. If you need to leave the place during the balancing procedure, disconnect the accelerometer BNC connector from the instrument and leave the accelerometer at the point from where the measurements are taken. If this is not possible, mark the position with a pen or paint! It is important that it is only the trial weights that will influence the vibrations and not the change in vibrations due to a different position of the transducer.

During the balancing procedure remember that:

- It is only possible to balance machines, where the unbalance is the major cause of vibration.
- Do not change the position of the vibration transducer after the start of the balancing procedure.
- Balancing using this method requires only three consecutive trial runs and changing the balance status of the rotor.
- Only measurement of the vibration level is needed.
- Balancing will only reduce the vibration caused by unbalance.
- **VIBER X3™** can display the frequency of the 5 highest peaks, unless one of them is the same as actual speed the cause of high vibration probably is something else.
- A balancing round will often be a good approach and a first attempt to find the reason for increased vibration. If the balancing attempt is not successful, the cause can be loose rotor parts or other faults.
- If the machine speed is variable, be sure to choose the same speed during every trial run. Do not search the speed that gives the highest vibration. Such speeds mostly show non-linear results.
- Start balancing with measuring the bearings in the directions (horizontal, vertical and axial). Select the direction in which the highest vibration is read. The highest vibration should be at the same speed/frequency as the machine speed/frequency, the highest vibration at this speed/frequency is normally imbalance.
- You must use the same radius for the trial weights and the balancing weights.
- Accuracy in balancing ensures a good result

10.1 3-point method for balancing

Three-point method has been further developed and adapted to **VIBER X3™**

The new balancing gives results fully comparable with advanced instruments. This has been achieved by measuring signal can be filtered with speed rate, this could not be done with older instruments, working exclusively on the total levels. Balancing Classes are available in standard ISO 1940-, there are recommendations for various applications. We can, with 3-point method and a **VIBER X3™** at normal rotor weights and speeds often balance to class G 2.5.

This method calculates the balancing weight and where to place it.
The balancing requires 5 starts / test runs

Test drives 1 – 5

1. Test drive 1, measures the unbalance before action
2. Test drive 2 with trial weight
3. Test drive 3 with trial weight
4. Test drive 4 with trial weight
5. Testing and verifying result

10.2 Important at all types of balancing are:

- The machine must have the same rotational speed at all tests
- The rotational radius must be the same for both trial weights and balancing weights.
- Placement of sensor must not be changed during balancing act
- Accuracy at measuring and mounting of trial weight is extremely important and critical for the result.
- The behaviour of some machines can be non-linear, and can therefore not be balanced without constructional changes as rigidity, mass or boundary conditions.

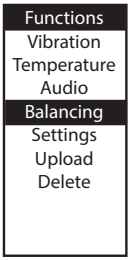
The manual is divided into two sections, one with preparation and one section with balancing runs.

10.3 Preparations before balancing act

Start **VIBER X3™** and press the green button, select with arrows:

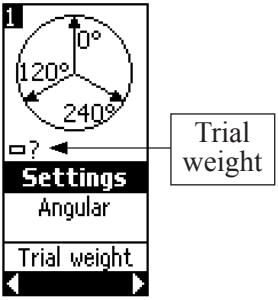
”Balancing” from the main menu, confirm with the green button.

1.



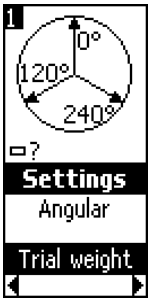
Setting the balancing parameters, the uper half shows the rotor and trial weight symbol. Rotor symbol has indicator for the trial weights placement. The symbol for the sample weight has question marks before the weight is selected.

2.



Move the marker to **”Trial weight”** and confirm with the green button

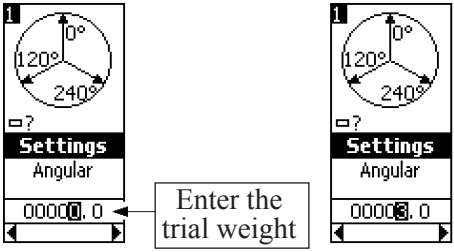
3.



10.4 Estimation/Calculation of mass of trial weight.

T = Trial weight, unit mass (grams)
W = Mass of rotor, unit mass (kg)
R = Turning radius of test weight, (mm)
S = Speed, (RPM)
Constant = 180 000

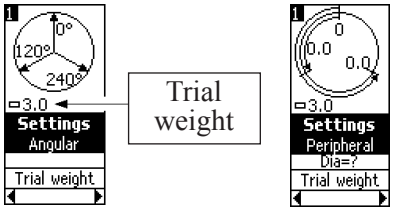
Example: W = 3,22 kg, R = 65 mm, S = 2972 RPM, wich gives T = 3,0 gram.
Enter the trial weight with the arrow keys and confirm with the green button



$$T_{grams} = \frac{W_{kg} \times 180000}{R_{mm} \times S_{rpm}}$$

10.5 Calculation of trial weight and position.

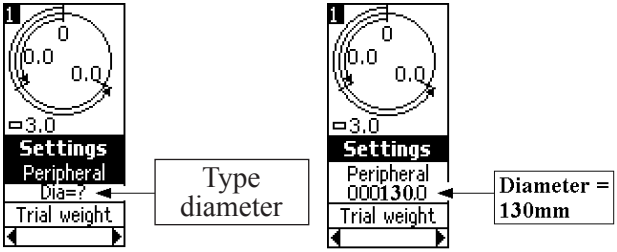
The instrument can calculate the position in two ways;
Angle calculation or length of the perimeter where the weight is placed. This is specified as angle or peripheral (length). The length is calculated in the instrument after the diameter is specified.

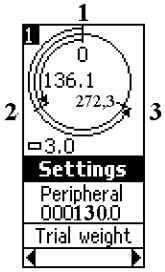


Move the highlight in the line that says **"Angle"** or **"peripheral"**. Select whether you enter the revolving portion of a diameter or angle by switching with the green button.**VIBER X3™** shows when trial weight placement as an angular measurement or the length of a circular arc. The diameter shall be given to the part of the rotor where the weights should be applied.

10.6 Calculating length of the arc

Measure the diameter and scroll down to ”Dia” (diameter) and press the green button. Enter the value of the line: ”Dia =?”.
Choose numbers with the up / down arrow keys. If the diameter is 130 mm enter the value and confirm with the green button.

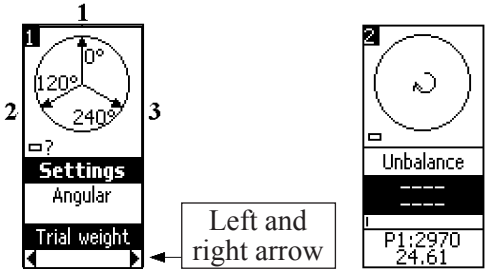




VIBER X3™ now calculates the distance to the periphery of the three test points. Remember these three points on the machine part with a pencil or marking tape. Mark the positions in the direction of zero (0) as (position 1) and others (Item 2) and (Item 3) in the direction towards the rotation.

10.7 Calculating the angle

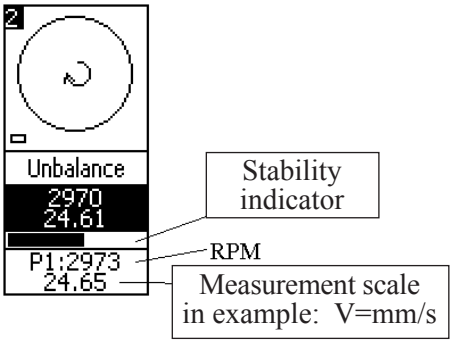
The instrument calculates the angle of the balancing weight. The runs to 0°, 120°, 240°, indicated that the test weight should be placed at these angles



Preparations of first test drive
Move the cursor to the field at the bottom that has a left and right arrow symbol, press the right arrow key * to display the screen for measurement.

**The left and right arrow key, provides a means to jump back and forward between the steps in the balancing procedure.*

10.8 Balancing



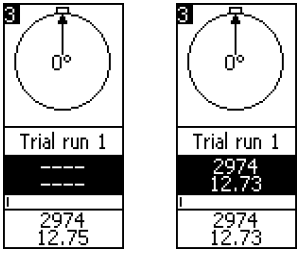
1) Start the machine, initial run

VIBER-X3™ measures and calculates the five largest amplitudes in the spectra. To reduce noice and disturbance the signal is filtered.

Check that the machine's base speed is shown on the "RPM" If not scroll using the up / down arrows until the speed of the machine is displayed. Wait, if possible, until the stabilization indicator has gone down to zero, or else try to save as stable value as possible, press the green button to save. Turn off the machine. Prepare the next measurement by stepping forward with the right arrow key.

2) Test run No:1

Install the selected sample weight (in our example. 3.0 grams) in the selected position (Pos.1). Start the machine, wait until it is stable measurement, preferably with the stability indicator is 0. Check that the speed is the same as last time, save with the green button. Turn off the machine. Prepare the next measurement by stepping forward with the right arrow key.



3) Test run No: 2

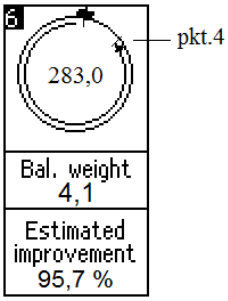
Moving the test weight from (position 1) to the calculated distance (in our example. 136.1 mm) towards the direction of rotation (Item 2), or if the angle calculation made to 120 °. Then do the same as test run No: 1.

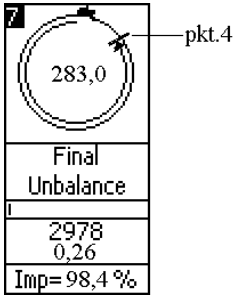
Test run No: 3

Move the test weight from (Item 2) to the calculated distance (in our example. 272.3 mm), calculated from (Item 1) towards the direction of (Item 3) or 240 ° of angle calculation used. Then do the same as when measured 1 and 2.

10.9 Balancing the machine

After driving 3 instrument automatically calculates the balance weight and where it should be placed, by pushing the right arrow appears in the display calculus (in our example. 4.1 grams) and a calculated improvement of 95.7%.





If the result is an error message, for example:
”Irrational vibration level” that means:
1. The machine is rigidly mounted
2. Sensor is incorrectly positioned
3. The trial weight is too small

Remove the test weight from pos.3 or 240 ° and fit the calculated weight of 4.1 grams to the calculated distance or angle indication in the instrument (in this example. 283.0 mm) starting from position 1 towards the direction to the position where the balancing weight be installed, position 4.

Checking the result

Scroll with the right arrow key to **Final unbalance**. Start the machne, check that the speed is the same as the previous runs, wait for stable readings. Confirm with the green button. The end result in this example was better (98.4%) than the estimated value. Balancing is now complete turn off the machine, attach the weight permanently.

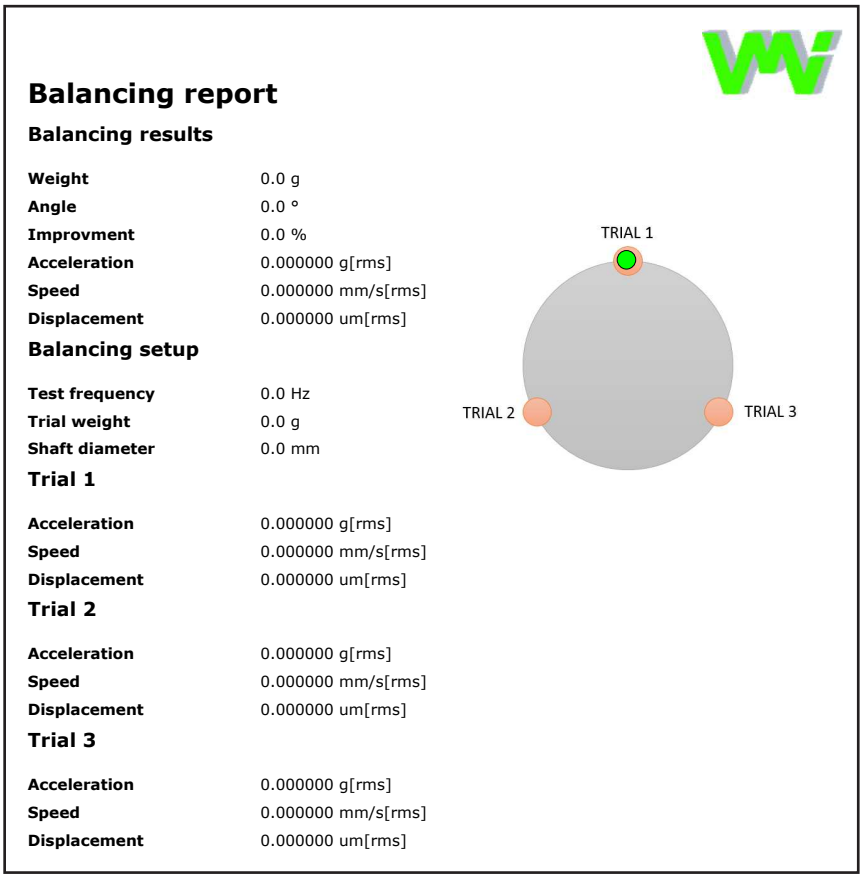
Save result

If balancing is to be saved, use the button ”Hold for SAVE key” select code under which file should be saved. Confirm with the green button.

10.10 Balancing screen

If you choose in the function menu, balancing.

If you want to make further improvement, you must start a complete new balancing using smaller trial weights. This is the disadvantages of the 3-point method compared with the Single plane balancing method.



11 Trend View software use for trends and route

This software is designed to trend measurement and this enables the users to monitor the condition in machines.

Trends are one method to perform condition monitoring (CM). **TREND VIEW ™** is designed for use only with **VIBER X3™**.

For every plant or building, you can create a database and a route with up to 100 measurements. Each measurement store vibration amplitude and bearing condition. If you also store Temperature, there is an additional space for 100 temperature measurements.

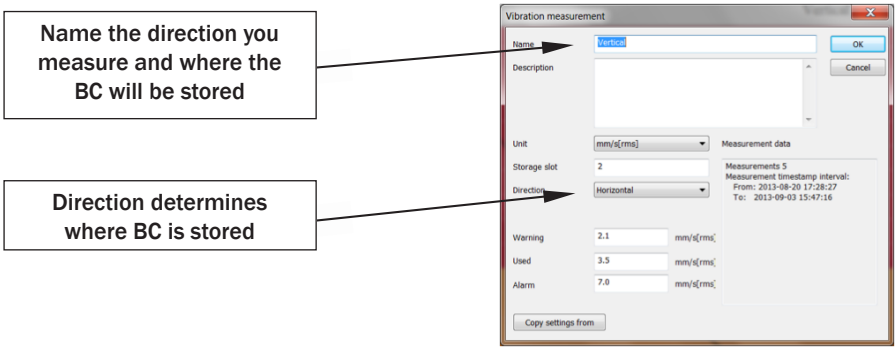
This covers normally 5- 20 machines, depending on how many directions are measured on every Bearing* and the number of Bearings. That amount is equivalent to number of measuring points in a route.

If only one direction is measured at each measuring point, choose the direction with the highest vibration. After the measurement, the data can be uploaded to the computer. In the computer you can store almost an unlimited number of machines. You can choose what unit you want to display in Trend View.

Analyzing this information, periodically, you can act proactively and avoid failures.

Regarding installation of the software, see the installation guide.

* Bearing condition is stored in horizontal direction on each Bearing. If you not measures this direction you must choose one of the direction you measure, change direction in properties.

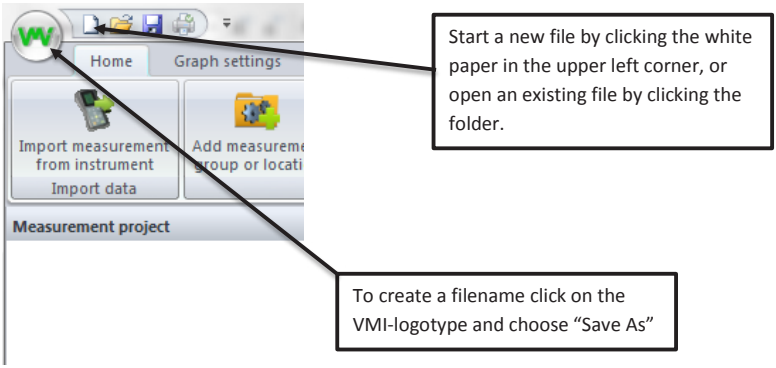


11.1 Start a Measuring Project

You need a project before you can start storing measurements.

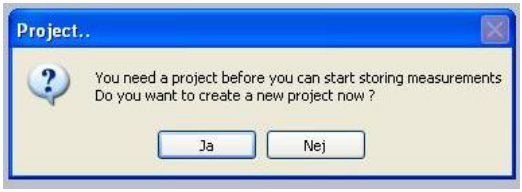
In this manual we are going to demonstrate how to set up measurements in two machines, Grinding Machine 1 and Grinding Machine 2. In both machines vibrations, bearing conditions and temperatures will be measured. The machines belongs to the grinding department.

Start the program by clicking the icon on your desktop, or choosing VMI Trend Viewer in the toolbar.

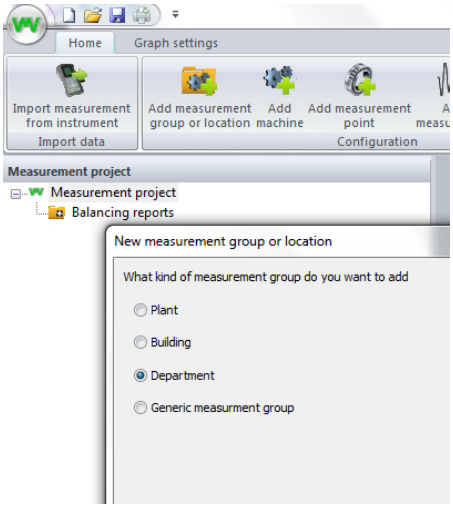

Home
Graph settings
Import measurement from instrument
Import data
Measurement project
Start a new file by clicking the white paper in the upper left corner, or open an existing file by clicking the folder.
To create a filename click on the VMI-logotype and choose “Save As”

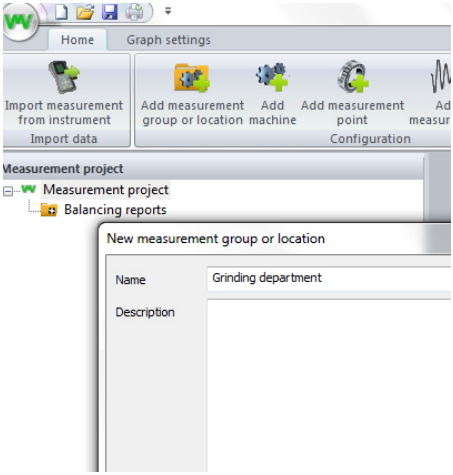
11.2 Set up the measurement project

Set up the new project by clicking “Add measurement group or location”. Depending on internal set-ups on measurements, you can make a hierarchically tree from the plant down to the measure point, or just setting up a single machine. In this example we choose “Department” (Grinding department) and adds two machines into the department.
After clicking the button “Add measurement group or location” the steps for continuing (if you have not clicked on the white paper) are the software will ask if you want to start a new project:

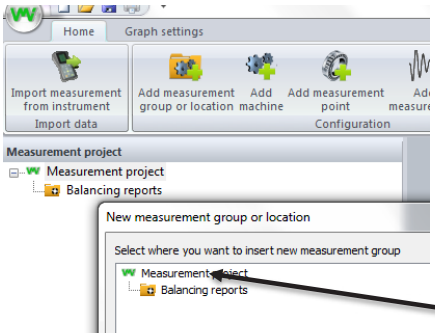


Press the “yes”-button in the dialog box and continue with marking “Department” or another of the top level alternatives. The top level of the database is usually a building or department, which must be added to a measurement project (the database).



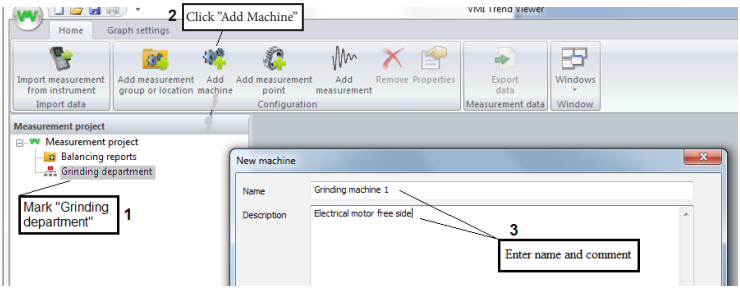


Thereafter, write the name of the department (and eventually description for internal use) and continue with “next”.



On the question “Select where you want to insert measurement group, mark ”Measuring project or balancing”.

And then press: Finish

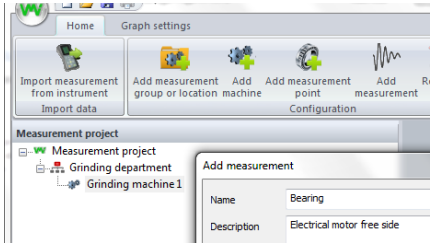


In the same way creates a new subfolder ”Grinding department”. The next step is to add a machine. Click ”Add machine” in the toolbar and write ”Grinding machine 1” in the dialog box.

11.3 Adding measurement points and measurements

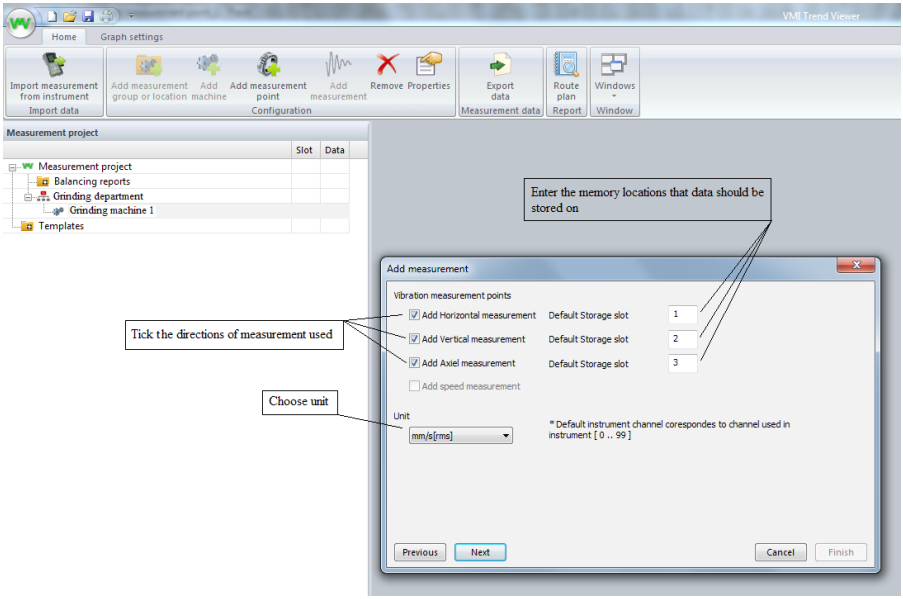
Then select the measurement point in the same way (usually a bearing). In this case we want to measure two bearings in three directions for each machine. Also temperatures shall be measured.

Click the “Add measurement point”-button, and write ”bearing” in the name field, and a description in the other (always follow the power’s way in the machine, start with not driven side)



Click next, and continue with adding the measurement points.

After that you choose the kind of measuring unit (normally start with vibration and direction), this example shows that choice. The storage slot where to store the measurement is also set.



Example:

In the storage table for vibration measurements:

Horizontal Storage slot: 1

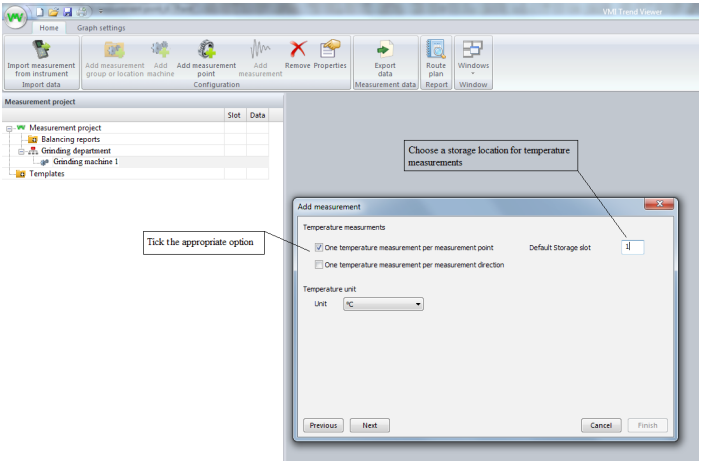
Vertical: Storage slot: 2

Axial Storage slot: 3

In the storage table for temperature:

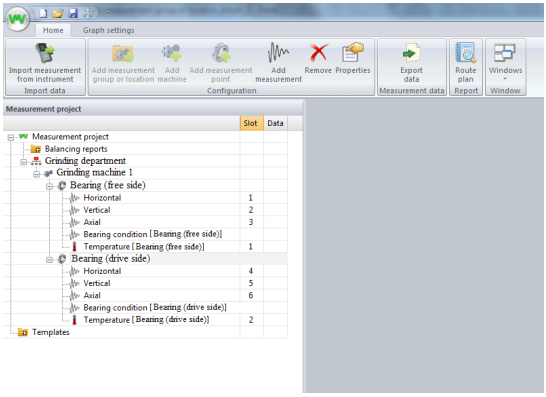
Temperature Storage slot: 1

Note: When measuring the bearing conditions are automatically generated and saved.
Temperatures and vibrations are stored in different tables, therefore the temperature readings are numbered separately.



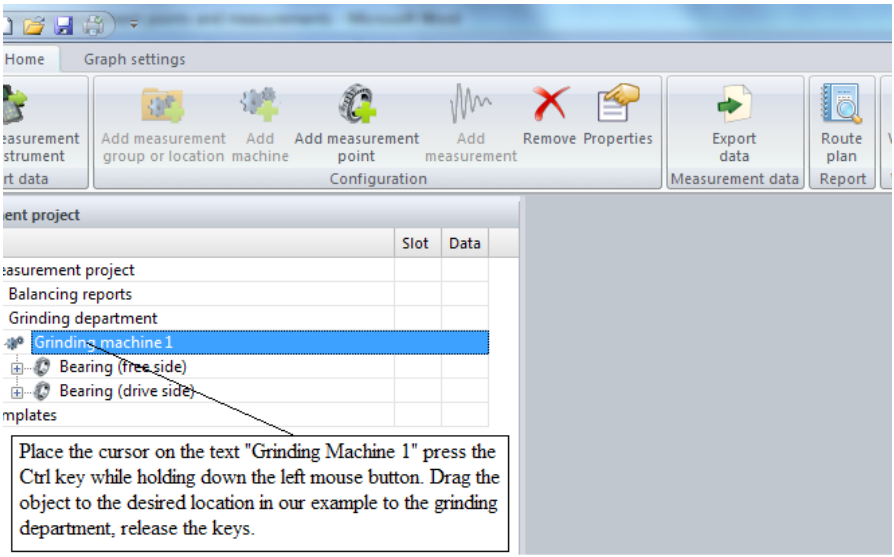
You will have an opportunity to choose the storage slot when the measurements are stored in the instrument and also at the uploading of the data. You need to notice where the measurement shall be stored in the computer (Measuring point and direction) (See also “Route Plan”).

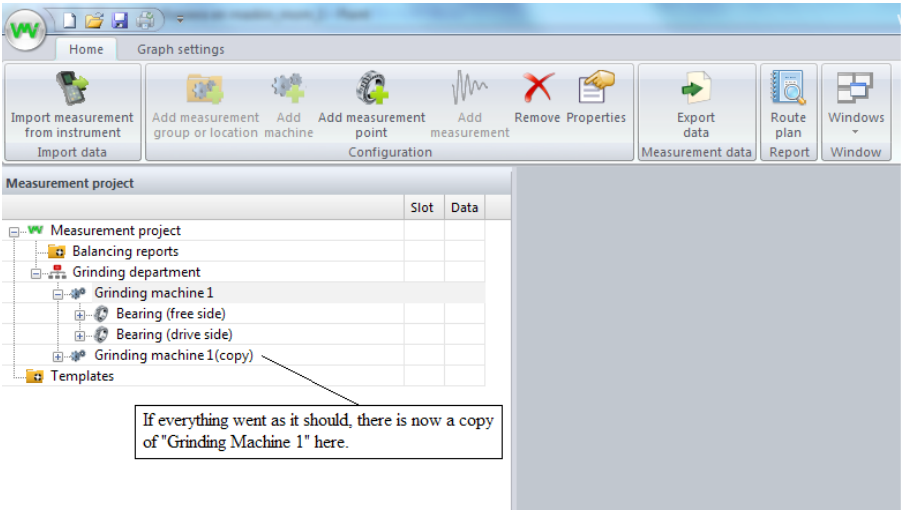
The appearance of the window is now:

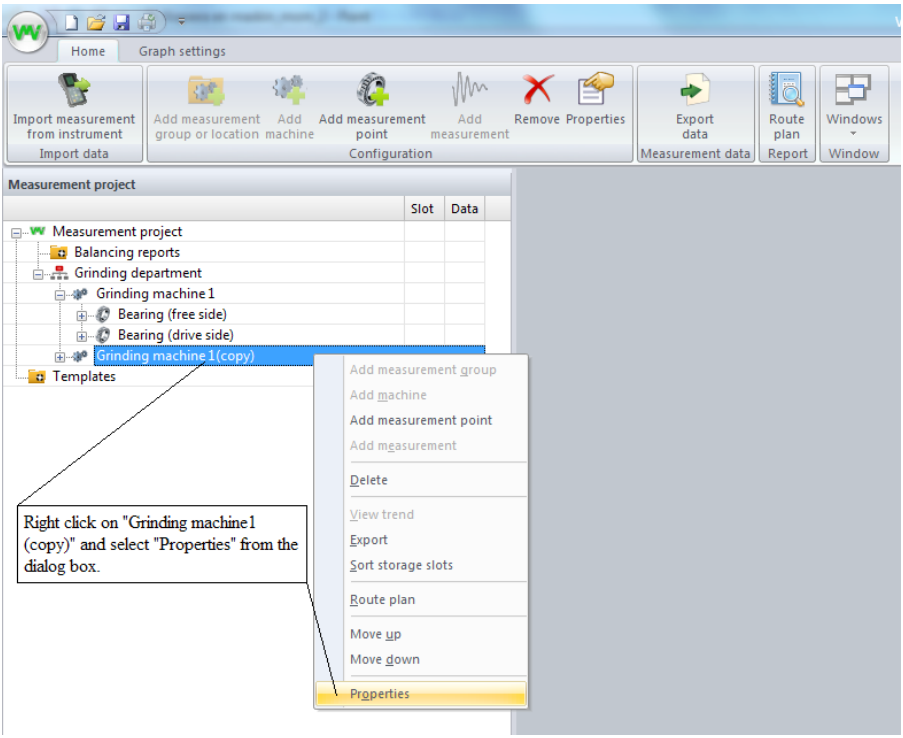


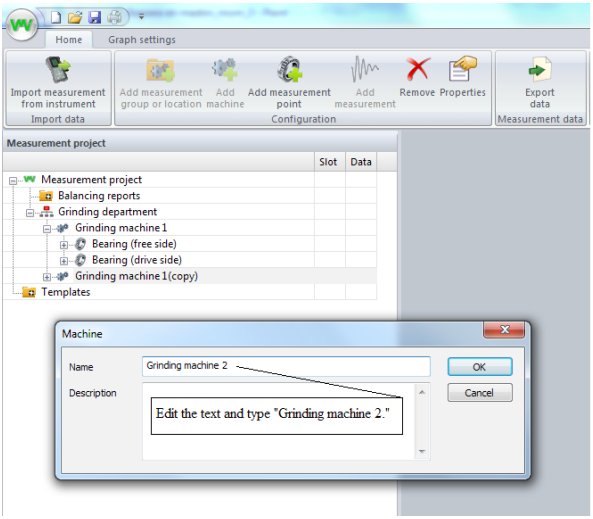
The same procedure are made for the second machine.

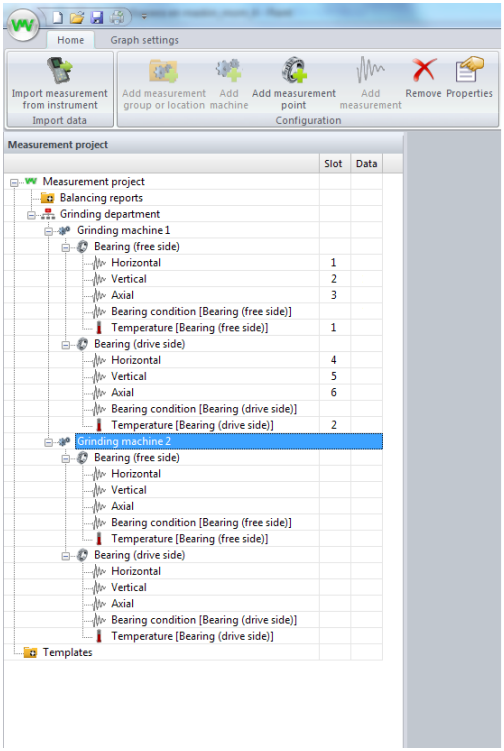
In order to expand the project with additional grinding machine 2, you can make a copy of the machine 1. Notice that you can copy machines by pressing **Ctrl** and **left mouse** button simultaneously and drag the item where you want to copy it, use only the left mouse button to move machines in the route.


Home
Graph settings
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Export data
Measurement data
Route plan
Report
Configuration
Slot
Data
Balancing reports
Grinding department
Grinding machine 1
Bearing (free side)
Bearing (drive side)
Place the cursor on the text "Grinding Machine 1" press the Ctrl key while holding down the left mouse button. Drag the object to the desired location in our example to the grinding department, release the keys.

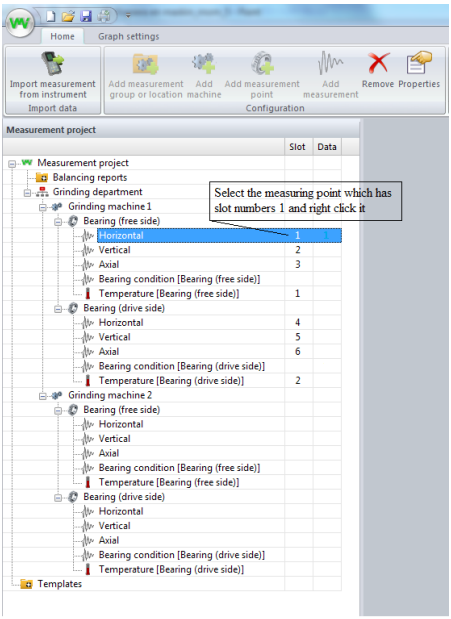

Home
Graph settings
Import measurement from instrument
Import data
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Configuration
Export data
Measurement data
Route plan
Report
Windows
Window
Measurement project
Slot
Data
Balancing reports
Grinding department
Grinding machine 1
Bearing (free side)
Bearing (drive side)
Grinding machine 1(copy)
Templates
If everything went as it should, there is now a copy of "Grinding Machine 1" here.

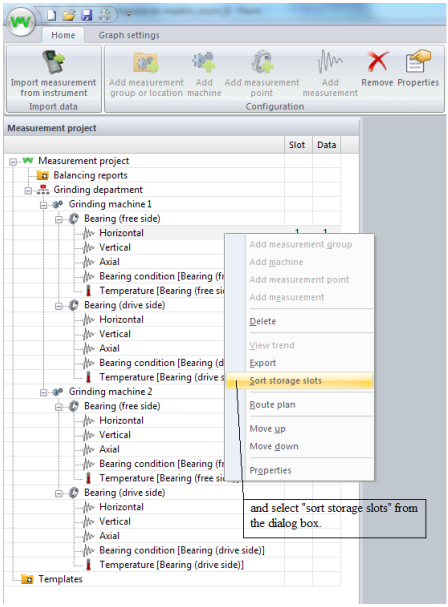

Home
Graph settings
Import measurement from instrument
Import data
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Configuration
Export data
Measurement data
Route plan
Report
Windows
Window
Measurement project
Slot
Data
Measurement project
Balancing reports
Grinding department
Grinding machine 1
Bearing (free side)
Bearing (drive side)
Grinding machine 1 (copy)
Templates
Add measurement group
Add machine
Add measurement point
Add measurement
Delete
View trend
Export
Sort storage slots
Route plan
Move up
Move down
Properties
Right click on "Grinding machine1 (copy)" and select "Properties" from the dialog box.

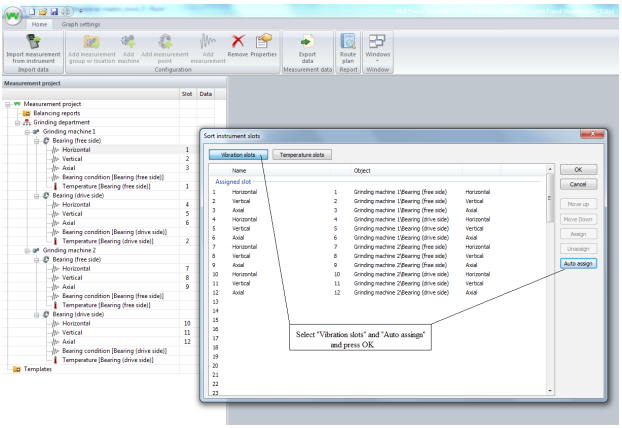


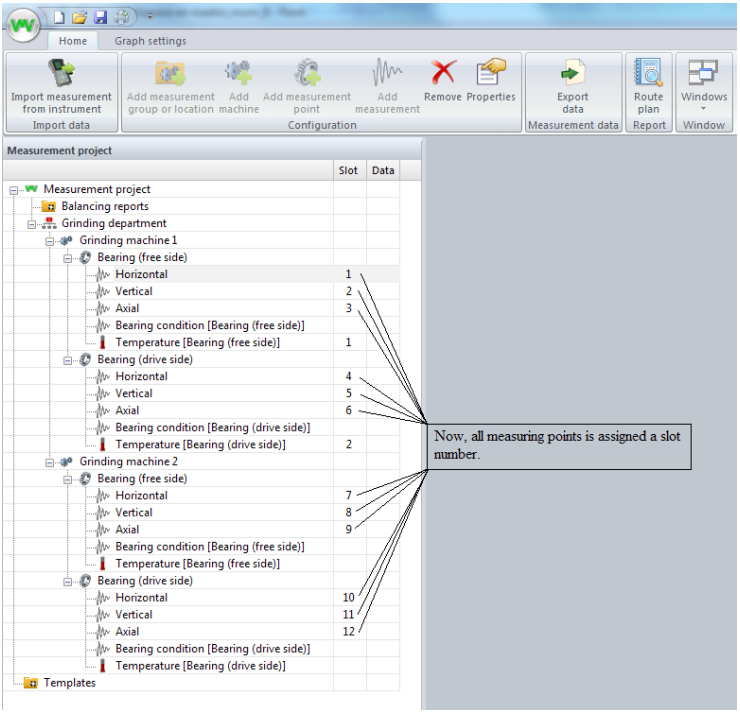


Expand all measurement points in the tree and we can now see that we must assign measuring points for grinding machine 2 slot number.

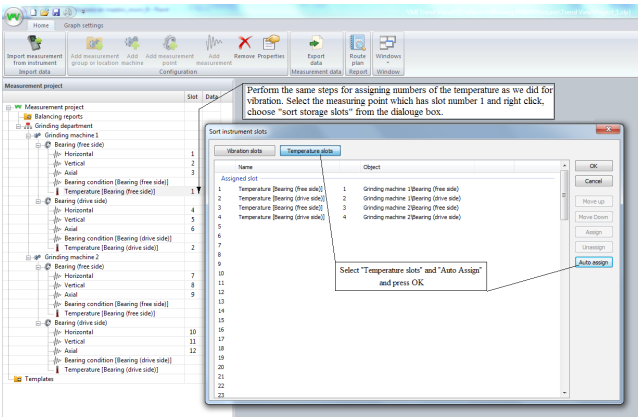

Home
Graph settings
Import measurement from instrument
Import data
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Configuration
Measurement project
Slot
Data
Measurement project
Balancing reports
Grinding department
Grinding machine 1
Bearing (free side)
Horizontal
Vertical
Axial
Bearing condition [Bearing (free side)]
Temperature [Bearing (free side)]
Bearing (drive side)
Horizontal
Vertical
Axial
Bearing condition [Bearing (drive side)]
Temperature [Bearing (drive side)]
Grinding machine 2
Bearing (free side)
Horizontal
Vertical
Axial
Bearing condition [Bearing (free side)]
Temperature [Bearing (free side)]
Bearing (drive side)
Horizontal
Vertical
Axial
Bearing condition [Bearing (drive side)]
Temperature [Bearing (drive side)]
Templates
Select the measuring point which has slot numbers 1 and right click it

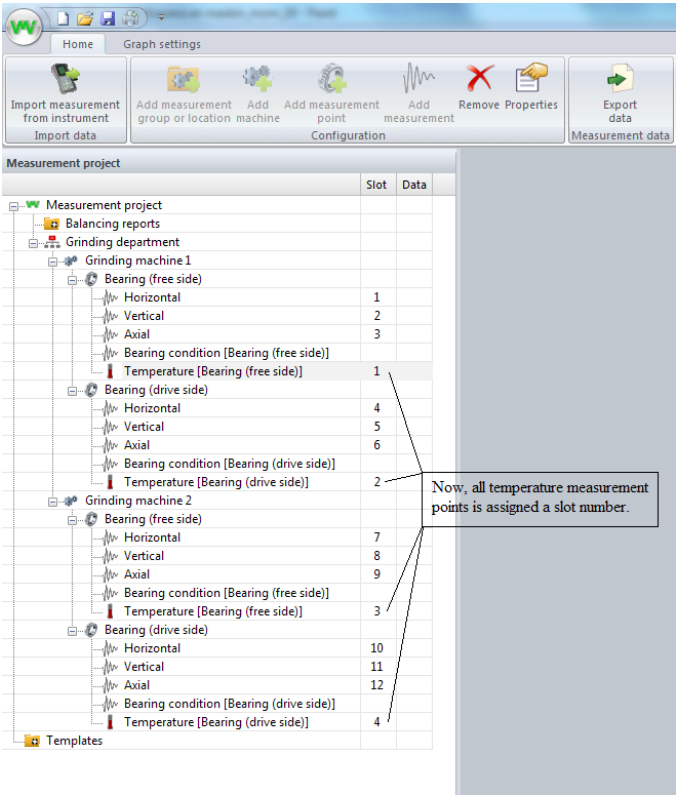

Home
Graph settings
Import measurement from instrument
Import data
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Configuration
Measurement project
Slot
Data
Add measurement group
Add machine
Add measurement point
Add measurement
Delete
View trend
Export
Sort storage slots
Route plan
Move up
Move down
Properties
and select "sort storage slots" from the dialog box.



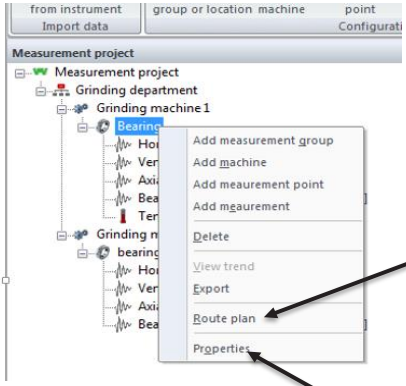


Bearing condition is stored in horizontal direction on each bearing. If you don't measure this direction you must choose one of the directions you measure, change direction in properties.


Perform the same steps for assigning numbers of the temperature as we did for vibration. Select the measuring point which has slot number 1 and right click, choose "sort storage slots" from the dialouge box.
Select "Temperature slots" and "Auto Assign" and press OK


Home
Graph settings
Import measurement from instrument
Import data
Add measurement group or location
Add machine
Add measurement point
Add measurement
Remove
Properties
Configuration
Export data
Measurement data
Measurement project
Slot
Data
Measurement project
Balancing reports
Grinding department
Grinding machine 1
Bearing (free side)
Horizontal 1
Vertical 2
Axial 3
Bearing condition [Bearing (free side)]
Temperature [Bearing (free side)] 1
Bearing (drive side)
Horizontal 4
Vertical 5
Axial 6
Bearing condition [Bearing (drive side)]
Temperature [Bearing (drive side)] 2
Grinding machine 2
Bearing (free side)
Horizontal 7
Vertical 8
Axial 9
Bearing condition [Bearing (free side)]
Temperature [Bearing (free side)] 3
Bearing (drive side)
Horizontal 10
Vertical 11
Axial 12
Bearing condition [Bearing (drive side)]
Temperature [Bearing (drive side)] 4
Templates
Now, all temperature measurement points is assigned a slot number.

11.4 Create Route Plan and editing database



You can extract a list (Route Plan) from the program to use as an orientation and reminder where the measuring points are located.

Right click in the Measurement Project at the actual location, Department, Building i.e. and choose “Route Plan” print out a list, this helps a lot when measuring the route.

When you have done this a part of your database are ready and can be stored in the computer.

If you need to edit anything in your database, mark the issue and click with the right button on your mouse and choose “properties”. All properties can be changed or renamed in the coming menus.

11.5 Measuring

Try to make the database with machines you want to measure within the same interval (weekly, monthly etc).
The machines to be included in the program provided by **VIBER X3™** and Trend View, PC program, must be fit with a measuring point/direction documented similar to the proposals contained in this manual.

When working with this route measurement, we recommend marking each point with a number that is always used in these measurements.

If measurements are made in 3 directions, the measurements will be saved at each measuring point, which normally are the bearings.

When you press the measurements on the Hold for SAVE key a proposal slot, where the data should be saved is showed, it can be accepted or moved to another measuring figure by arrows. Up and down Arrows moves the slot one number, side Arrows moves 10 numbers (all seen in the display).

When the ✎ is pressed, the measurement is saved and the instrument continues to measure. If you not want to save, press the Hold for SAVE key once more and you get back to measure mode.

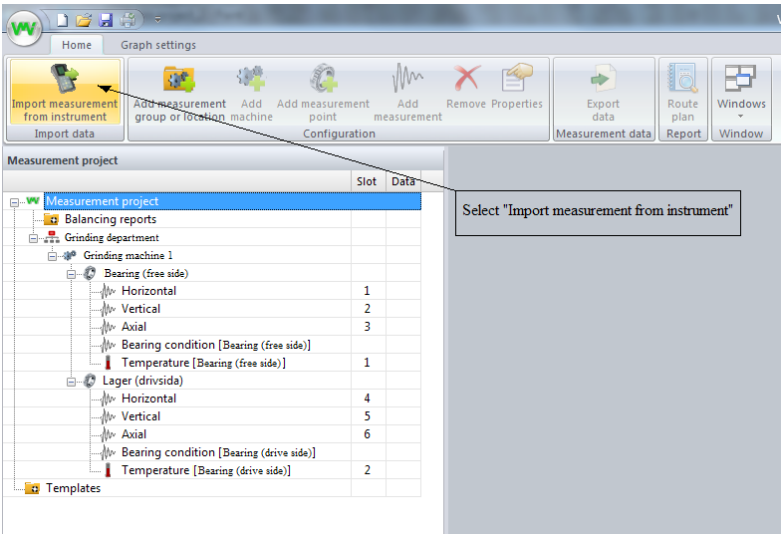
11.6 Upload measures

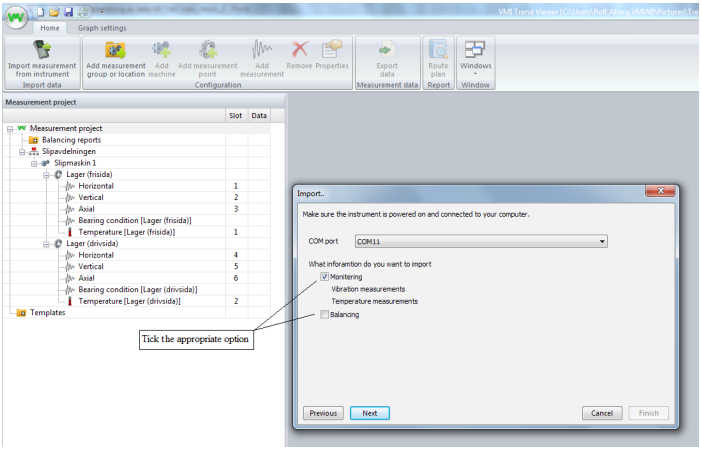
When the measurements on the machine/machines are complete, data should be uploaded to the computer program.

1. Connect the cable to the instrument's "s**erial data connector**" (it is the same as the headphone jack) and to the computers **USB connector**. You need to verify that the correct serial port is selected by the computer, otherwise correct the chosen serial port. (In case of problems, see installations guide for PC software)

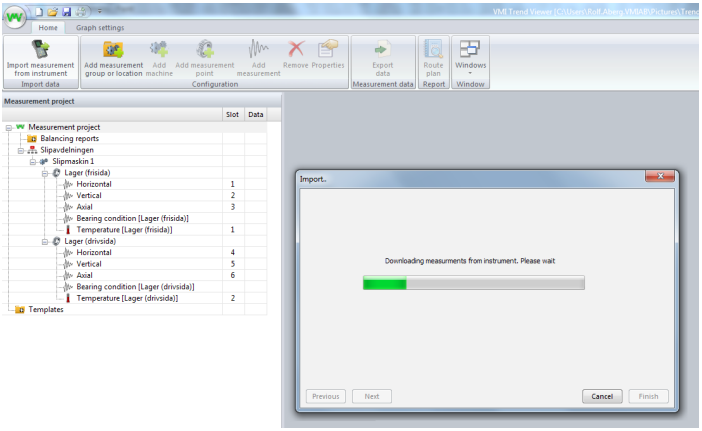
2. Put the **VIBER X3™** in the mode "Upload"

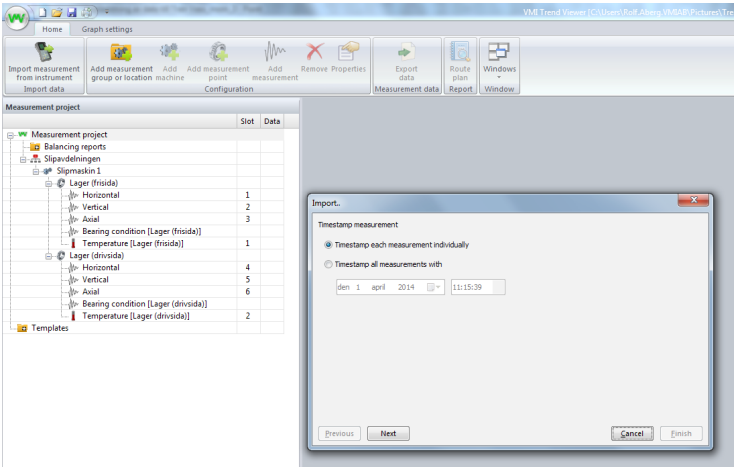
3. Open the Trend View Software and select "Import measurement from instrument"



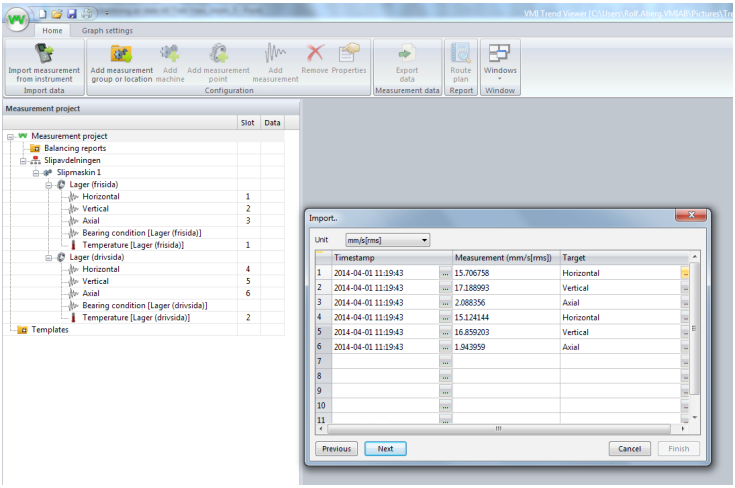


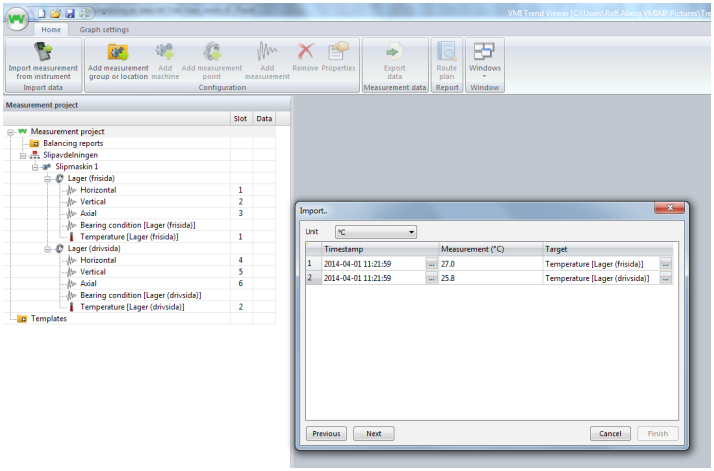
Click on next



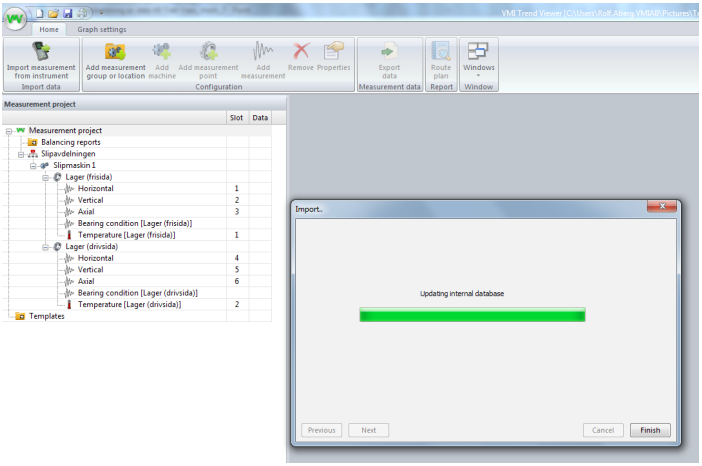


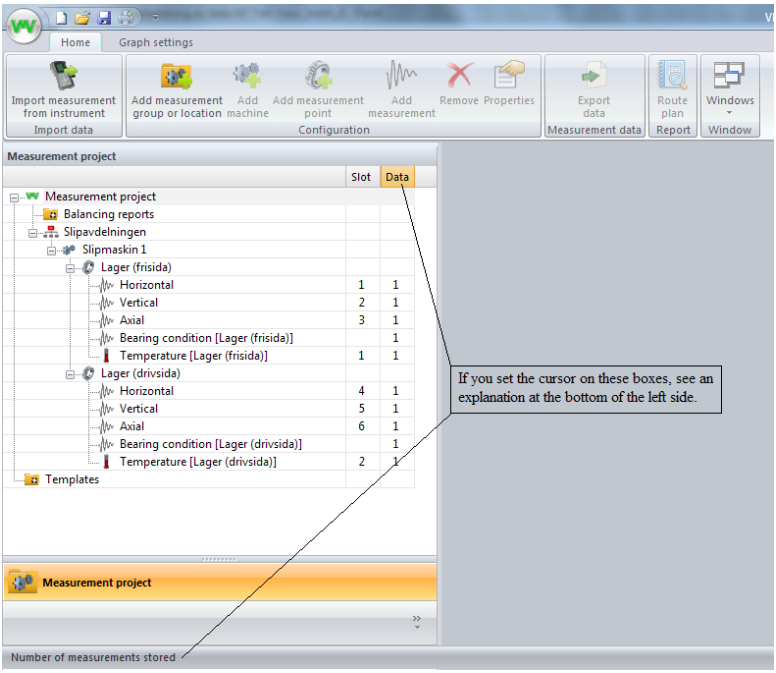
4. As the instrument doesn't store times for the measuring, just the time for Uploading, it is possible to set times and storage slots during the uploading process. Adjust the table by ticking the boxes that belong to the machine that the data comes from. If you need to set dates manually, mark "Timestamp each measurement individually". If not, all measurments will be stamped with the same time.

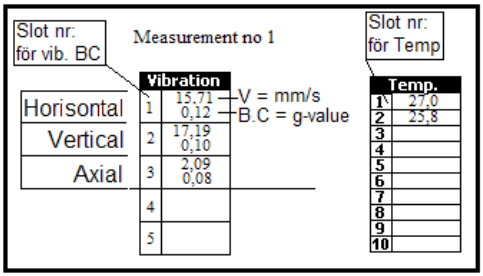




Click on next

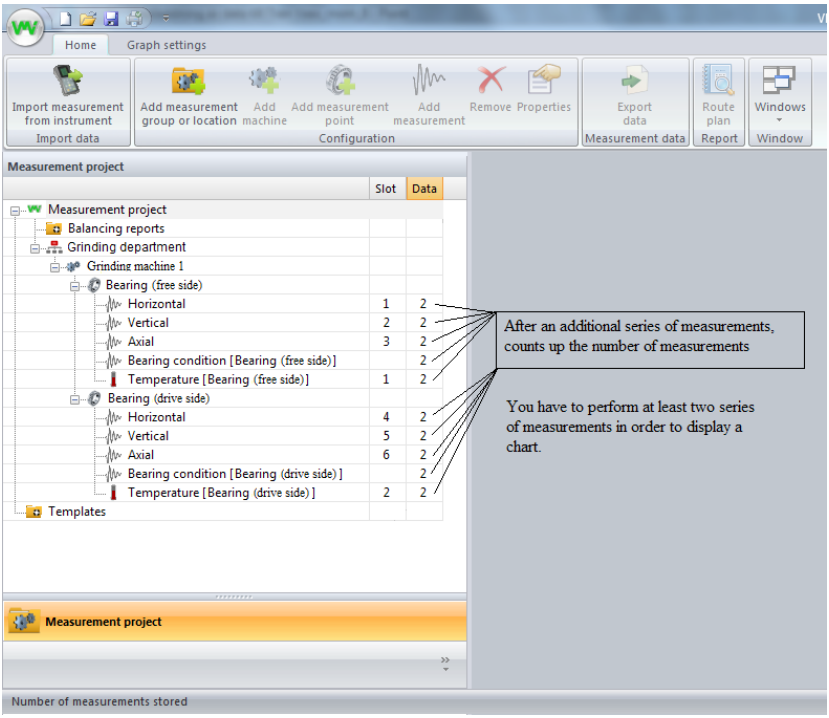






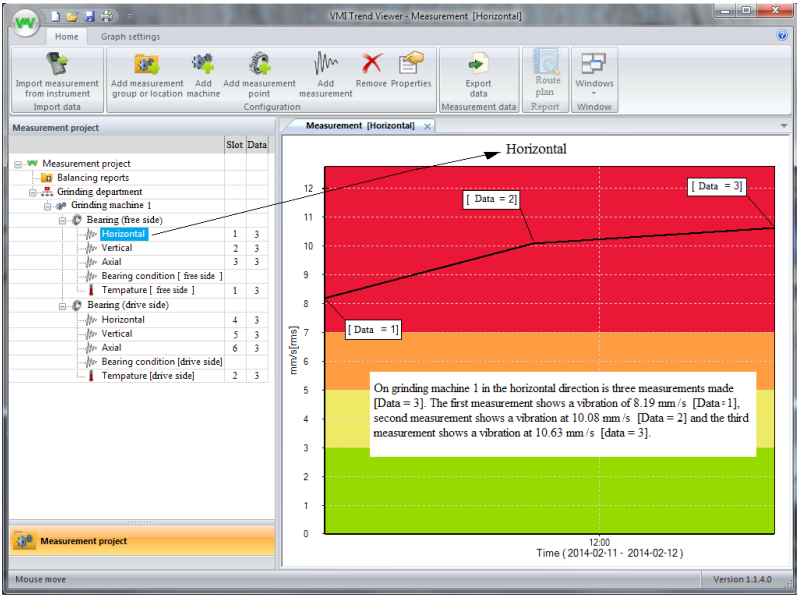
Data for the vibrations and temperatures are stored in separate tables and can therefore have the same slot number but in the different tables.

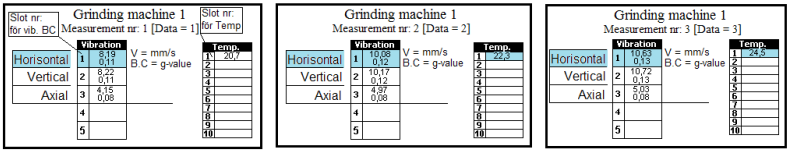
Screen shots showing where data is stored in **VIBER X3™**. It takes three memory locations to store the three directions of measurement (horizontal, vertical and axial). How to find these menus are discribed on page 7.



For example, the next day when you have performed a new series of measurements, repeat transmission of measurement data to the PC as the previous example. Data for the first series of measurements is stored in the database and the data for the second series of measurements are now stored and number of measurements counts up.

To view a chart, double-click on the measurement direction you want to see.





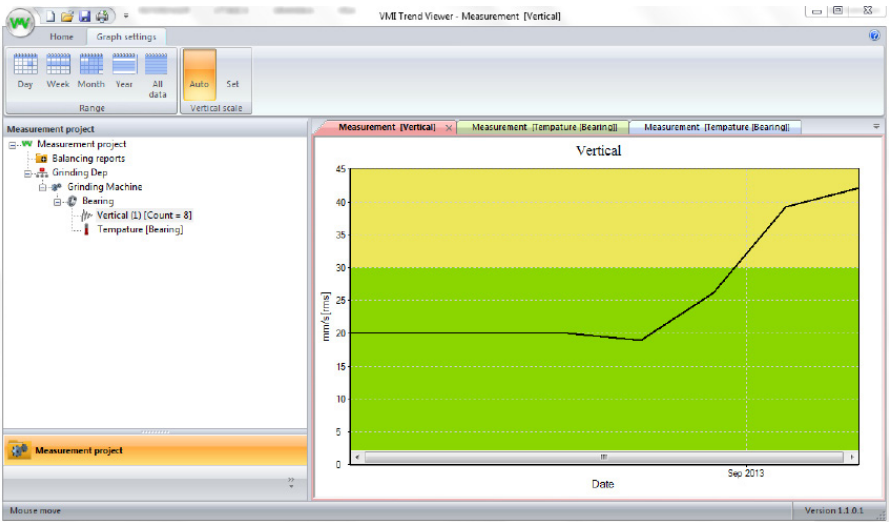
Screen shots showing where the data is stored in **VIBER X3™**. How to find these menus are described on page 7.

11.7 Viewing trends

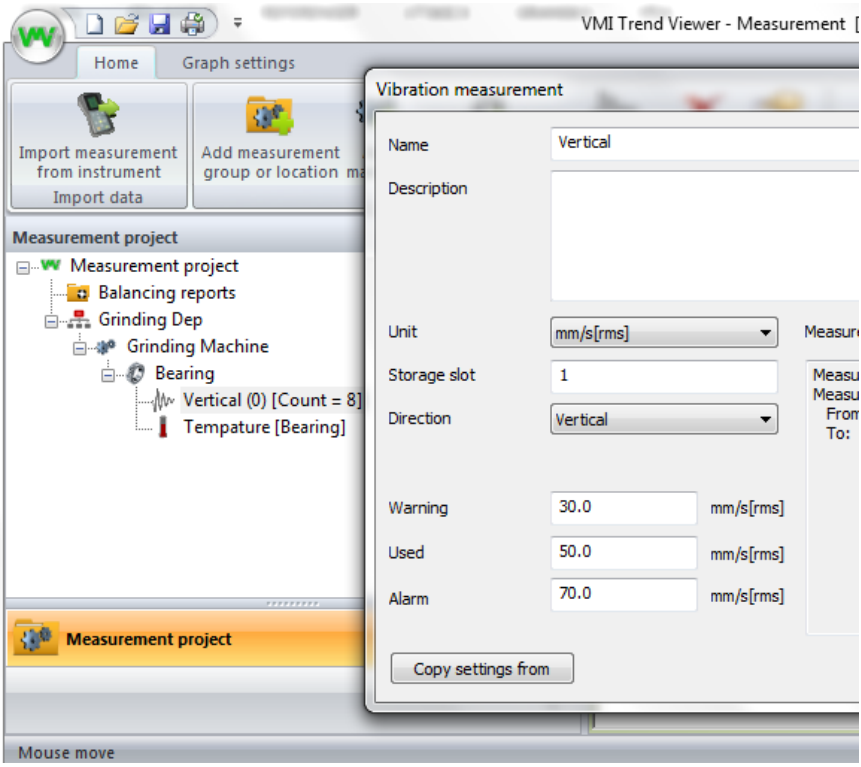
When all measurements are saved you can choose the graphics and see the changes from the start of the measurements.

Choose the direction for the trend diagram you want to study.

To view the measured data just double click on the measurement in the project tree. The window showing the measures are automatically adjusted to the values that are shown. For changing the visual range just use the toolboxes in the header.



Property, can be used for changing the unit displayed in the Diagram, all measuring points are available in all units like Velocity, Acceleration and Displacement.



If there has been a remarkable change in the vibration or Bearing condition, we advise you to measure and monitor that machine or Bearing with shorter intervals.

Technical data VIBER X3™

Vibration	Accelerometer	Standard nom 100 mV/g	(Selectable sensitivity in the instrument) 0,1 - 99999 mV/g
Input amplitude range	Vibration	Max 50 g RMS	With other sensor up to 500 g
	Bearing condition	Max 30 gBC	
Dynamic range	80 dB (159 Hz with auto ranging)		
Frequency range	Vibration	2 - 400 Hz 10 - 1000 Hz 6 - 1600 Hz 11 - 3200 Hz	Note 1
	Bearing condition	0,5 to 16 kHz	
Vibration units	g-value, m/s², mm/s, in/s, µm, mils		Note 2
Amplitude presentation	RMS, Peak, Peak-Peak		Note 2
Analysis	Five highest peaks can be displayed		VMI Trend View Software included for PC
Frequency range of peak detection	Frequency range		Note 3
	2 - 400 Hz		
	6 - 1600 Hz		
	11 - 2000 Hz		
	10 - 1000 Hz		
Storage capacity	100 measurements can be stored		
Three-point balancing	10 balancing results can be stored		
Communication interface	USB 2.0		
Sound frequency Filter enabled	60 Hz - 10 kHz	+26 dB to -4.1 dB	
	500 Hz - 10 kHz	+26 dB to -4.1 dB	
Temperature sensor Range	Built-in infrared sensor		Temp. Sensor measures down to -20°C but the instrument ambient temp. must be 0°C or higher
	-20 to +120°C		
Accuracy	Vibration	± 3 %	Note 4
	Bearing condition	± 5 %	Note 4a
	Frequency/RPM	± 0.2 %	
	Temperature		Note 4b
Battery	Rechargeable Lithium	2300 mA/h, max 60°C	Note 5
Operating time	1 week normal use		Note 6
External charger	5,0 V regulated @2000 mA		
LCD display	B&W 64 x 128 pixels with background light		Note 7
Enclosure protection	IP65		
Operating temp. range	0 to 50°C		Note 8
Weight	415 gram		Note 9
Size (L x W x H)	165mm x 80mm x 50mm		

Note 1 User selectable, between Hz and RPM.

Note 2 User selectable.

Note 3 Same as ”frequency range”, except for 11-3200 Hz range, where peak detection ands at 2000 Hz.

Note 4 Full scale is 50g for acceleration other units are frequency dependent.

Note 4a Over 0.5 gBC.

Note 4b Emissivity factor must be set in accordance with the target surface.

Note 5 Capacity of the batteries can vary depending on hardware revision. Max 2300 mAh. (storage temp. -20 to max 60°C).

Note 6 Operating time depends on backlight, volume level and batteries used. Backlight adds 40mA and the sound volume up to 150 mA. Charging time is approx: 6-12 hours.

Note 7 Operating temp. min 0°C to max 50°C, storage temp. max 72°C.

Note 8 The restriction concerns display.

Note 9 Instrument, including battery and transducer.

OBS.

If you can change to another accelerometer, then you have to change the senstivity (mV/g). This is done in the menu under ”Transducer”.

VMI declares that the **VIBER X3™** is manufactured in conformity with national and international regulations.

The system complies with, and is tested according to, following requirements:

EMC Directive:	2004/108/EC
Low Voltage Directive:	2006/95/EC

Vibration Measurement Instrument International AB (VMI)

Warranty disclaimer

VMI warrants the products to be free from defects in material and workmanship under normal use and service within two years from the date of purchase and which from our examination shall disclose to our reasonable satisfaction to be defective. Warranty claimed products shall be returned prepaid to VMI for service. We reserve the right to repair or to replace defective products. Always try to explain the nature of any service problem; by e-mail or telephone. Check first all natural problems, like empty batteries, broken cables, etc. When returning the product, be sure to indicate that the purpose is to make repairs and indicate the original invoice number and date of shipment to you, if possible.

Warranty exclusions

Damage not resulting from a defect in material or workmanship or by other than normal use. Damage resulting from repairs performed other than by an authorized service centre. The limited two year warranty and remedies co tained herein are in lieu of all other warranties, expressed or implied including any warranty of merchantability and any warranty of fitness for a particular purpose, and all other remedies, obligations or liabilities on our part. In addition, we hereby disclaim liability for consequential damages for breach of any expressed or implied warranty, including any implied warranty of merchantability and any implied warranty of fitness for a particular purpose. The duration of any implied warranty which might exist by operation of law shall be limited to one year from the date of original retail purchase.

NOTE: Some countries do not allow the exclusion or limitation of consequential damages, and some countries do not allow limitation on how long an implied warranty lasts, so the above exclusions or limitations may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from country to country. If you have problems with your instrument during or after the warranty period, first contact the distributor you purchased the unit from.

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